CORPORATE FORECASTING

FERTILITY TRENDS AND THEIR IMPLICATIONS ON POPULATION GROWTH IN EDMONTON, 1987-2002

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FERTILITY TRENDS AND THEIR IMPLICATIONS ON POPULATION GROWTH IN EDMONTON, 1987 - 2002

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ABSTRACT

Two major trends in Edmonton demography, mutually related, can be identified. The first is that the fastest population increase is occurring in old age groups. The other, related feature, is that although Edmonton fertility indicators show consistent increase in the past decade, the reproductive behaviour of the population puts it below replacement level. These trends will catch-up with Edmonton, as with most other North-American cities, and if no continuous influx of net-immigration will occur, a decline in Edmonton's population should be expected within the next 30 years. The 1986 net-reproduction rate (the expected number of girls to be born to an Edmonton woman during her lifecycle) is at 0.85, up 3 points from 0.82 in 1978. Thus, although the net reproduction rate is rising, it is still below 1, the replacement level for females. The number of births in Edmonton is increasing presently (8,053 in 1978 versus 10,810 in 1986) but the crude birth rate (births per 1,000 population) is decreasing with the rapid rise of persons in post-reproductive ages. The decrease in the crude birth rate is the net-result of continuing overall decline in age-specific birth rates. Noteworthy anomaly in this trend, however, is the increase in birth rates of older reproductive age-groups of women, i.e., those in the 35-44 years category. The crude birth rate calculated on the basis of the 1987 Civic Census is 18, and it is expected to decline to 15 live births per thousand at the turn of the century. This points to the volatile nature of birth rates and actual population increase, as a result of changing child bearing behaviours. A population forecast utilizing the 1987 Edmonton demographic database, shows that the number of live births in Edmonton will keep increasing but it will start declining as soon as 1994. Accordingly, the numbers in the age-group 0-4 will start declining around 1996, whereas the numbers of persons 70+ show consistent increase throughout the forecast.

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1. Introduction

The importance of population forecasting to urban planning is generally accepted and overall problematics of population projections for large cities has been reviewed on occasions. Less known, however, are the problems emerging in population forecasting in urban areas smaller than one million persons. Demographic changes in subnational or sub-provincial populations, which are "small" in traditional demographic terms, carry much significance for their population growth. Changes in urban populations have often greater demographic impact than in larger populations where demographic change appears to be more gradual.

All demographic forecasting where age-distribution is considered involves the cohort-component projection method. Presently two adaptations of the traditional population projection methodology for urban regions emerge. For multiregional forecasts of small areas a multiregional demographic model was introduced by Rogers (1968, 1975) and a simultaneous projection of population and households has been more recently introduced by the author (Akkerman, 1980). These methods require comprehensive availability of population, household and vital statistics data (Akkerman, 1985).

For single-region demographic forecasts, where the city or the region as a whole is considered a single geographic unit, the traditional cohort-component method has been applied in a straightforward fashion for populations usually larger than one million. For cities smaller than one million, however, such application yields problems that may require adjustment of demographic rates observed over short periods of time.

Another issue in urban population forecasting are the demographic components themselves. Until recently, migration was the overwhelming factor in urban demographic analysis. This was certainly true with regard to Edmonton where large influx of in-migrants had rapidly transformed the demographic picture during the seventies and early eighties.

This situation is changing and migration no longer is a dominant component of population growth in many cities. With this, the relevance of urban fertility in municipal demographic analysis and forecasting, is becoming increasingly apparent. Fertility - and changes in fertility - have almost immediate implications in the urban context. A difference of 3,000 births within a period of 5 years in a city of 600,000 persons has implications for retail business catering for children, for pediatric and other medical care and for the quality and quantity of day care centres. Thus, a distinction between urban and regional fertility indicators is in place, and has indeed been made. A concise illustration of differences between urban and regional population growth are Figures 1 and 2, showing the varying pace of growth between Edmonton and Alberta.

Edmonton provides a good example of a medium-size city with good demographic data sources. In addressing the issue of urban fertility, its measurement and estimation, the context of city population growth must be borne in mind. This paper will review, in particular, past and future trends in fertility and population growth in Edmonton. It will show, further, how the urban demographic data sources, fertility data in particular, can be utilized for custom population projections.

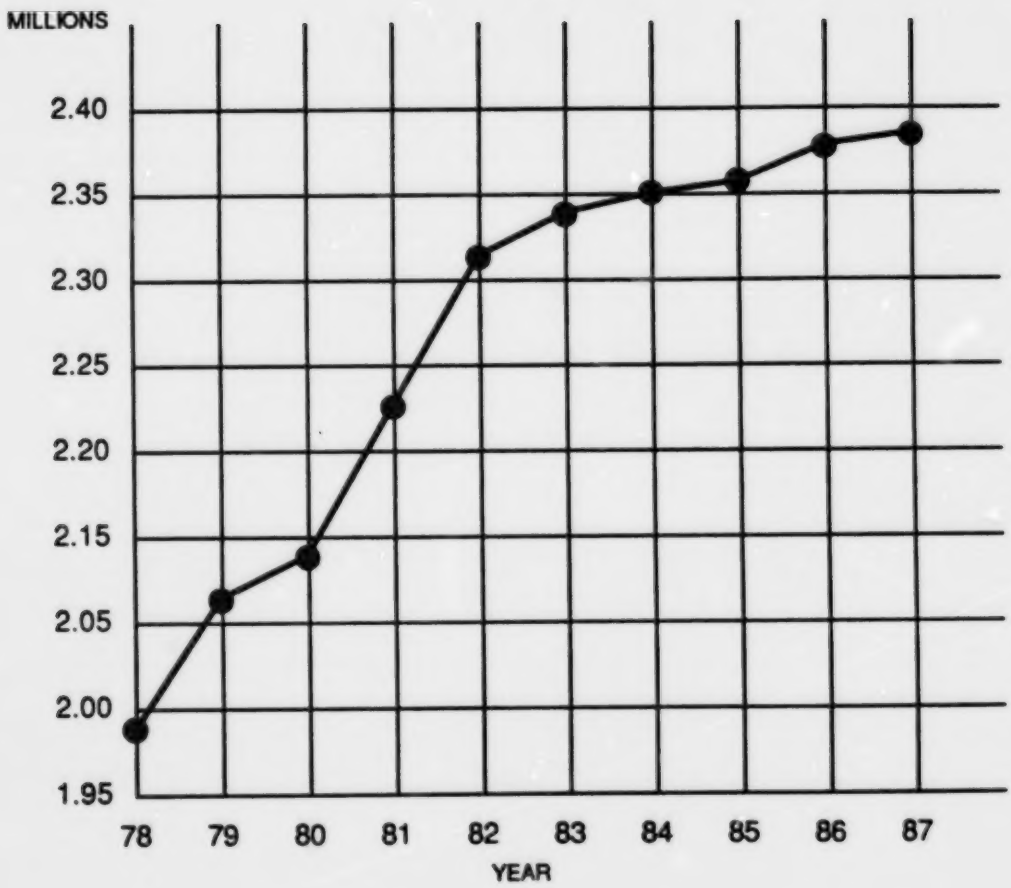

Figure 1: Alberta Population, 1978 - 1987

Source: Alberta Statistical Review, 4th Quarter, 1987

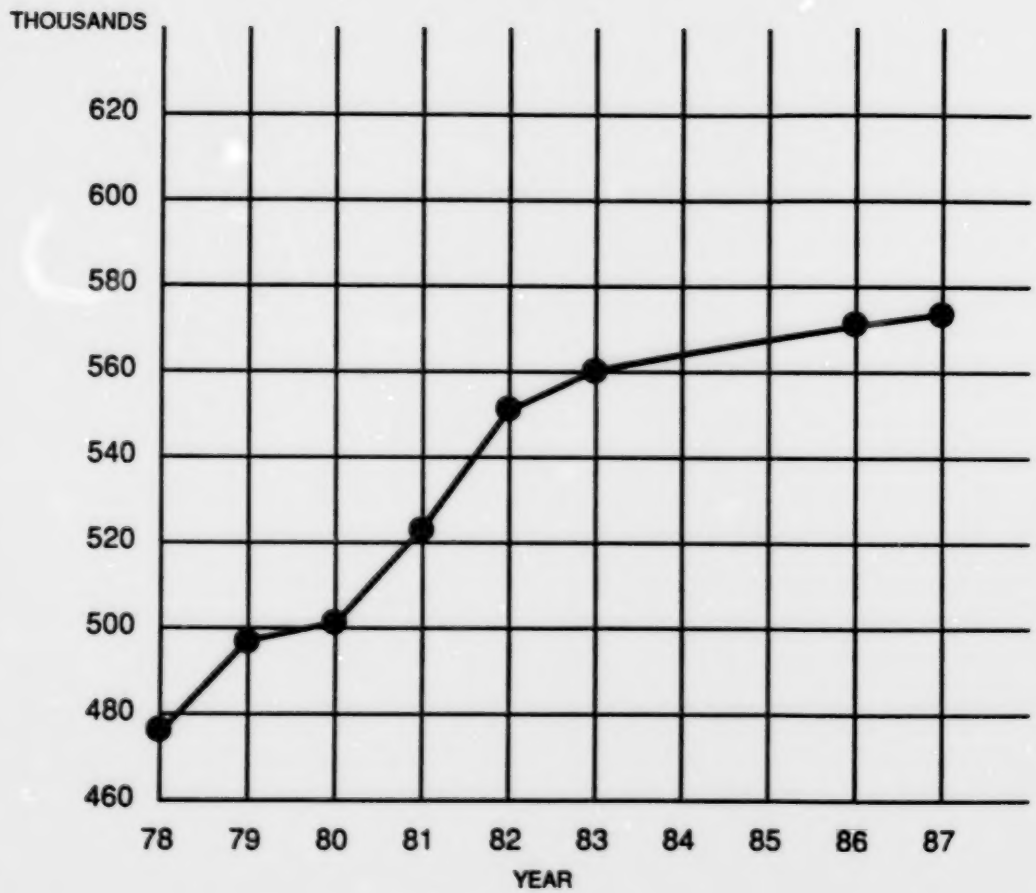

Figure 2: Edmonton Population, 1978 - 1987

Source: Edmonton Civic Censuses, 1978 - 1987

2. The Problem of Urban Fertility in Population Forecasting

While provincial population projections for Alberta are available from both federal and provincial sources (Statistics Canada, 1985; Alberta Bureau of Statistics, 1987) city forecasts are not readily available. Since the introduction of the iterative procedure for population projection by Leslie (1945), demographic forecasts have been prepared mainly for countries (or regions) rather than cities. The problem of applying traditional demographic forecasting methods to relatively small areas has begun to emerge only in the sixties and seventies (Keyfitz and Flieger, 1971; Rogers, 1975). Dealing with urban population change, planners and demographers alike have concentrated their efforts on the issue of migration. Accordingly, most problems addressed in literature in relation to urban population growth and projections have dealt with migration and migration determinants. The problem of urban fertility has not received enough attention, if at all, within the context of urban population growth and projections.

When dealing with the issue of fertility in urban demographic forecasts, the accepted convention has been the adoption of national, or provincial, birth rates in urban population projections (Keyfitz and Flieger, 1971: 114-116). Such measures may be inevitable in countries or regions with poor vital statistics records. In the case of Edmonton, however, urban vital statistics data are available and, thus, the question that emerges is, how to utilize these data for more accurate city population projections.

Demographic data for Canadian cities usually available from national statistics sources are for 5-year age groups (see e.g. Statistics Canada,

1983). Single-year demographic data are offered for areas that are usually no smaller than a province. The hesitancy associated with the use of age groups smaller than 5 years in urban areas of less than one million is well justified. Random variations occurring in small demographic groups such as single-year age groups of a city population, can have critical impact on the accuracy of any forecast.

Age distribution and the number of live births by age of mother (along with mortality data) provide a basis to derive fertility rates by single-years of age of mother. However, due to the random variation, these data are not usually taken literally when various demographic rates are derived. When deriving urban demographic rates an adjustment procedure of the primary data can be undertaken. This procedure will be reviewed in the following, within the context of its integration in urban population projections.

3. Urban Demographic Data Sources

Population projections utilize a demographic database which provides the assumptions as well as the initial data for the actual forecasts. The Edmonton demographic database is updated annually or bi-annually. The database consists of single-year demographic data for males and females. The updating of the database is done by means of collection or estimation of most current demographic information. The introduction of fertility rates into the database is of particular concern here.

Fertility data available for Edmonton are obtained on a periodic basis from the Edmonton Board of Health or Alberta Social Services, for single years of age of mother. These data include the number of live births, during a period of time, to mothers usually resident at Edmonton. Such data collection is commissioned for periods of one year commencing on the reference date of the Edmonton Civic Census, which is April 1. The Civic Census is conducted annually or bi-annually, and provides a general information on population age-sex distribution, employment, migration and housing (see e.g., Planning Department, 1983; Planning and Building Department, 1988). Tables 1 and 2 show summaries for 5-year age groups from the Civic Census, from the Alberta Bureau of Statistics and from the Edmonton Board of Health.

It is an inherent feature of the cohort-component methodology that intervals of age groups and intervals of time within the forecast period are identical. Thus, a projection based on 5-year age groups can yield only a forecast with 5-year time-intervals throughout the forecast period. Such a situation is unsatisfactory for most planning purposes. Urban forecasts are often needed

for the more immediate future of 1 to 5 years. Yet, rates based on calculations relating to very small populations are unreliable. The dilemma of urban population forecasting, therefore, can be presented as follows: forecasts are usually needed for time-intervals of single-years; however, base demographic data by single-years of age, fertility in particular, are susceptible to random variation distortions.

The following will examine the use of urban demographic statistics, fertility statistics in particular, for the incorporation of adjusted demographic rates in population projections. In the course of this review fertility trends in Edmonton and Alberta will be examined. In seeking and applying fertility rates to actual population projections, two issues must be taken into consideration:

a) Trends in fertility

b) Accuracy of current or observed rates.

These two issues will be reviewed with a particular reference to demographic data available for Edmonton.

4. Measurements of Fertility and Trends in Natural Increase, Alberta and Edmonton, 1978-1986

The patterns detected in Edmonton fertility along with those of Alberta are reviewed in Tables 1 and 2. The Tables show fertility indicators for each of the selected years of the past decade for both Edmonton and Alberta and they imply consistent fertility trends. In order to follow these trends, a review of the measures of fertility is given in the Appendix.

Observing the two sets of Tables for Alberta and Edmonton, a consistent trend is detected in almost all of the fertility indicators, in the period between the years 1978 and 1986:

Total Fertility Rate (TFR)
- Consistently fluctuating between 1.93 and 1.95 for Alberta.
- Consistently increasing from 1.63 to 1.78 for Edmonton.

Gross Reproduction Rate (GRR)
- Slightly increasing for Alberta from 0.94 in 1978 to 0.95 in 1986.
- Increasing from 0.78 in 1978 to 0.87 in 1986 for Edmonton.

Net Reproduction Rate (NRR)
- Slightly increasing for Alberta from 0.92 in 1978 to 0.94 in 1986.
- Significantly increasing for Edmonton from 0.76 in 1978 to 0.85 in 1986.

TABLE 1 FERTILITY INDICATORS, CITY OF EDMONTON 1978 - 1986

YEAR	AGE	FEMALES	LIVE BIRTHS	AGE SPECIFIC BIRTH RATE	SEX-AGE SPECIFIC BIRTH RATE	AGE
1978	10-14	17219	10	0.00058	0.00028	10-14
	15-19	24544	989	0.04029	0.01931	15-19
	20-24	33220	2846	0.08567	0.04105	20-24
	25-29	24624	2691	0.10928	0.05237	25-29
	30-34	17634	1206	0.06839	0.03277	30-34
	35-39	14121	256	0.00351	0.00869	35-39
	40-44	12530	44	0.00016	0.00168	40-44
	unknown				0.00008	unknown
				0.32603	0.15623	
1981	10-14	17149	10	0.00058	0.00028	10-14
	15-19	25527	1080	0.04231	0.02027	15-19
	20-24	37340	3179	0.08514	0.04079	20-24
	25-29	28703	3419	0.11908	0.05706	25-29
	30-34	20747	1599	0.07707	0.03693	30-34
	35-39	15189	357	0.02350	0.01126	35-39
	40-44	13452	48	0.00357	0.00171	40-44
	unknown			0.00024	0.00011	unknown
				0.35149	0.16842	
1983	10-14	16782	3	0.00018	0.00009	10-14
	15-19	20370	889	0.04364	0.02107	15-19
	20-24	38327	3374	0.08803	0.02450	20-24
	25-29	35835	4134	0.11536	0.05570	25-29
	30-34	25326	1958	0.07731	0.03733	30-34
	35-39	18718	484	0.02586	0.01248	35-39
	40-44	15129	47	0.00311	0.00150	40-44
	45-49	13255	2	0.00077	0.00037	45-49
	unknown		8			unknown
				0.35427	0.17105	
1986	10-14	15243	6	0.00037	0.00018	10-14
	15-19	20635	753	0.03649	0.01787	15-19
	20-24	35049	2785	0.07946	0.03892	20-24
	25-29	35333	4096	0.11593	0.05678	25-29
	30-34	27707	2485	0.08969	0.04393	30-34
	35-39	20934	632	0.03019	0.01479	35-39
	40-44	15789	53	0.00336	0.00164	40-44
				0.35548	0.17412	

	1978	1981	1983	1986
NUMBER OF NEWBORN MALES	4189	5049	5637	5515
NUMBER OF NEWBORN FEMALES	3855	4645	5262	5295
RATIO FEMALES TO TOTAL POPULATION	0.479	0.479	0.483	0.490
TOTAL FERTILITY RATE	1.630	1.757	1.771	1.777
GROSS REPRODUCTION RATE	0.781	0.842	0.855	0.871
NET REPRODUCTION RATE	0.761	0.822	0.838	0.853
MEAN AGE AT CHILDBIRTH	26.678	26.969	27.004	27.574
VARIANCE OF AGE AT CHILDBIRTH	32.097	32.864	34.326	32.984
INTRINSIC RATE (NORMAL FIT)	-0.01016	-0.00725	-0.00653	-0.00573
MEAN LENGTH OF GENERATION	26.841	27.088	27.116	27.668

Sources: Edmonton Civic Censuses
Edmonton Local Board of Health
Alberta Vital Statistics

TABLE 2 FERTILITY INDICATORS, PROVINCE OF ALBERTA, 1978 - 1986

YEAR	AGE	FEMALES	LIVE BIRTHS	AGE SPECIFIC BIRTH RATE	SEX-AGE SPECIFIC BIRTH RATE	AGE
1978	10-14	87027	40	0.00046	0.00022	10-14
	15-19	103532	4183	0.04040	0.01965	15-19
	20-24	104732	12463	0.11900	0.05787	20-24
	25-29	89728	12024	0.13400	0.06517	25-29
	30-34	75623	5357	0.07084	0.03445	30-34
	35-39	57618	1120	0.01944	0.00945	40-44
	40-44	50115	193	0.00385	0.00187	40-44
	unknown		11	0.00023	0.00011	unknown
				0.38822	0.28881	
1981	10-14	87430	42	0.00048	0.00023	10-14
	15-19	104725	4126	0.03940	0.01916	15-19
	20-24	127305	13925	0.10938	0.05320	20-24
	25-29	113650	15388	0.13540	0.06585	25-29
	30-34	94215	7045	0.07478	0.03637	30-34
	35-39	69495	1583	0.02278	0.01108	35-39
	40-44	55635	224	0.00403	0.00196	40-44
	unknown		21	0.00002	0.00020	unknown
				0.38666	0.18804	
1983	10-14	86900	23	0.00026	0.00013	10-14
	15-19	98500	3406	0.03458	0.01676	15-19
	20-24	129100	14428	0.11176	0.05418	20-24
	25-29	126600	17084	0.13494	0.06542	25-29
	30-34	101000	8145	0.08064	0.03910	30-34
	35-39	82300	1984	0.02411	0.01169	35-39
	40-44		244	0.00399	0.00194	40-44
	unknown		10	0.00019	0.00009	unknown
				0.39048	0.18931	
1986	10-14	84900	46	0.00054	0.00027	10-14
	15-19	91100	4944	0.05427	0.02659	15-19
	20-24	115600	14542	0.12580	0.06164	20-24
	25-29	128700	15604	0.12124	0.05941	25-29
	30-34	112400	7362	0.06550	0.03209	30-34
	35-39	92700	1636	0.01765	0.00865	35-39
	40-44	68200	229	0.00336	0.00165	40-44
	unknown		14	0.00026	0.00013	unknown
				0.38861	0.19042	

	1978	1981	1983	1986
NUMBER OF NEWBORN MALES	18179	21756	23351	22632
NUMBER OF NEWBORN FEMALES	17212	20598	21973	21745
RATIO FEMALES TO TOTAL POPULATION	0.486	0.486	0.485	0.490
TOTAL FERTILITY RATE	1.941	1.933	1.952	1.943
GROSS REPRODUCTION RATE	0.944	0.940	0.947	0.952
NET REPRODUCTION RATE	0.924	0.919	0.928	0.935
MEAN AGE AT CHILDBIRTH	26.463	26.761	26.969	25.886
VARIANCE OF AGE AT CHILDBIRTH	29.269	30.476	29.680	30.731
INTRINSIC RATE (NORMAL FIT)	-0.00300	-0.00313	-0.00279	-0.00259
MEAN LENGTH OF GENERATION	26.506	27.809	27.010	25.926

Sources: Alberta Bureau of Statistics

Age Specific Birth Rate - Consistently fluctuating at about 0.05 for Alberta, in age group 30-39. Consistently increasing from 0.04 in 1978 to 0.06 in 1986 for Edmonton, in age group 30-39.

The TFR, crude birth rates and GRR are presented for both Edmonton and Alberta in Figures 3-5.

The above measures as well as the additional measures, detailed in Tables 1 and 2, indicate that fertility is slightly on the rise throughout the Province as a whole, and it is rising consistently and more rapidly for Edmonton. At the same time, the various fertility measures show, provincial fertility rates are higher than those for the city, almost certainly due to higher fertility rates in rural Alberta.

The trend of rising fertility in Edmonton is consistent with an all-Canadian trend that has been reported in the public media since the early 1980's (e.g., The Edmonton Journal, May 25, 1987). Fertility, at least in Canada in the past decades, has been subject to periodic fluctuations. The baby-boom after World War II (1945-1955) indicated rise in fertility rates across Canada, and in Edmonton in particular. The present rise in fertility may echo that baby boom.

The speculation is that the majority of the baby-boom offspring are presently in their late thirties, many of them professionals. The demographic trait of these persons is to postpone marriage and family building until the

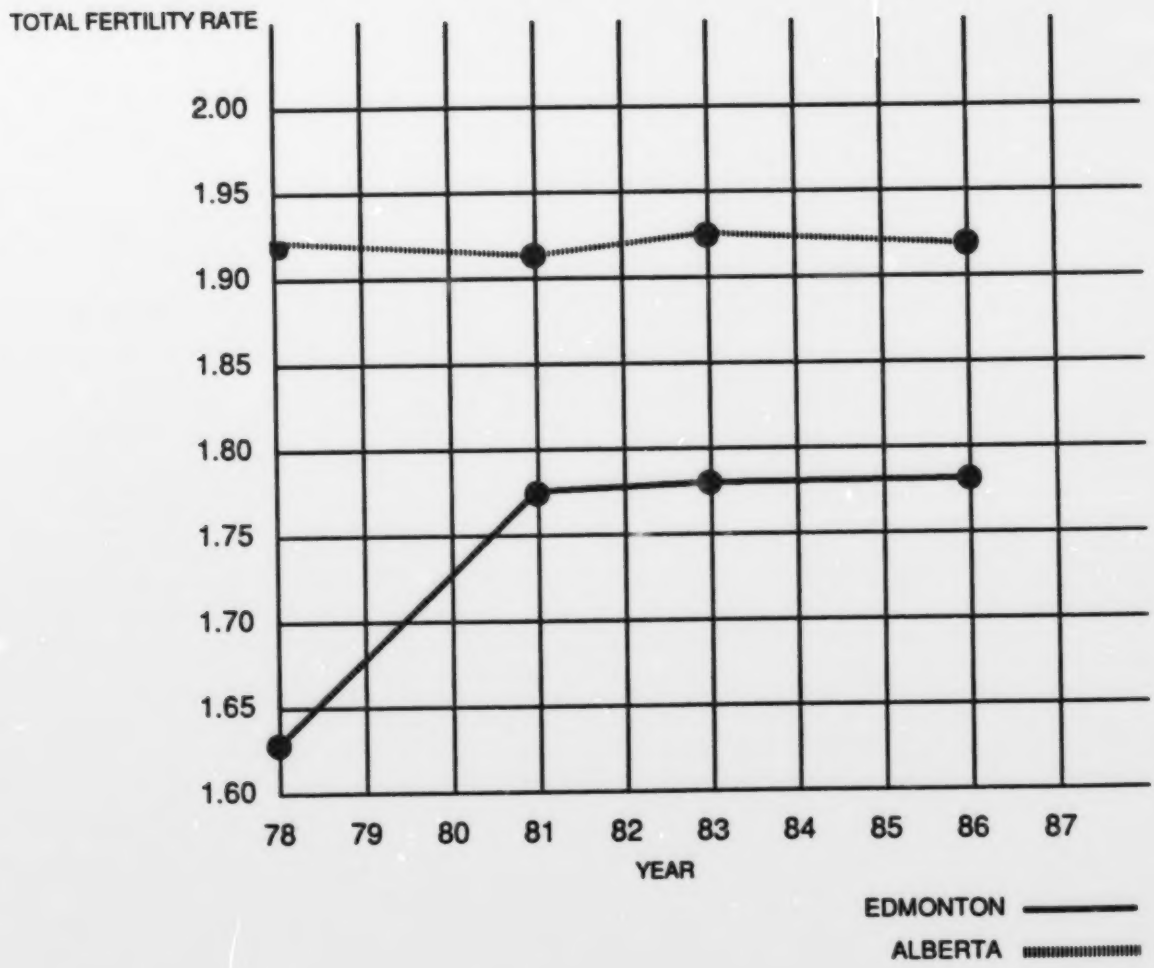

Figure 3: Total Fertility Rates, Edmonton and Alberta, 1978 - 1986

Source: Tables 1 and 2

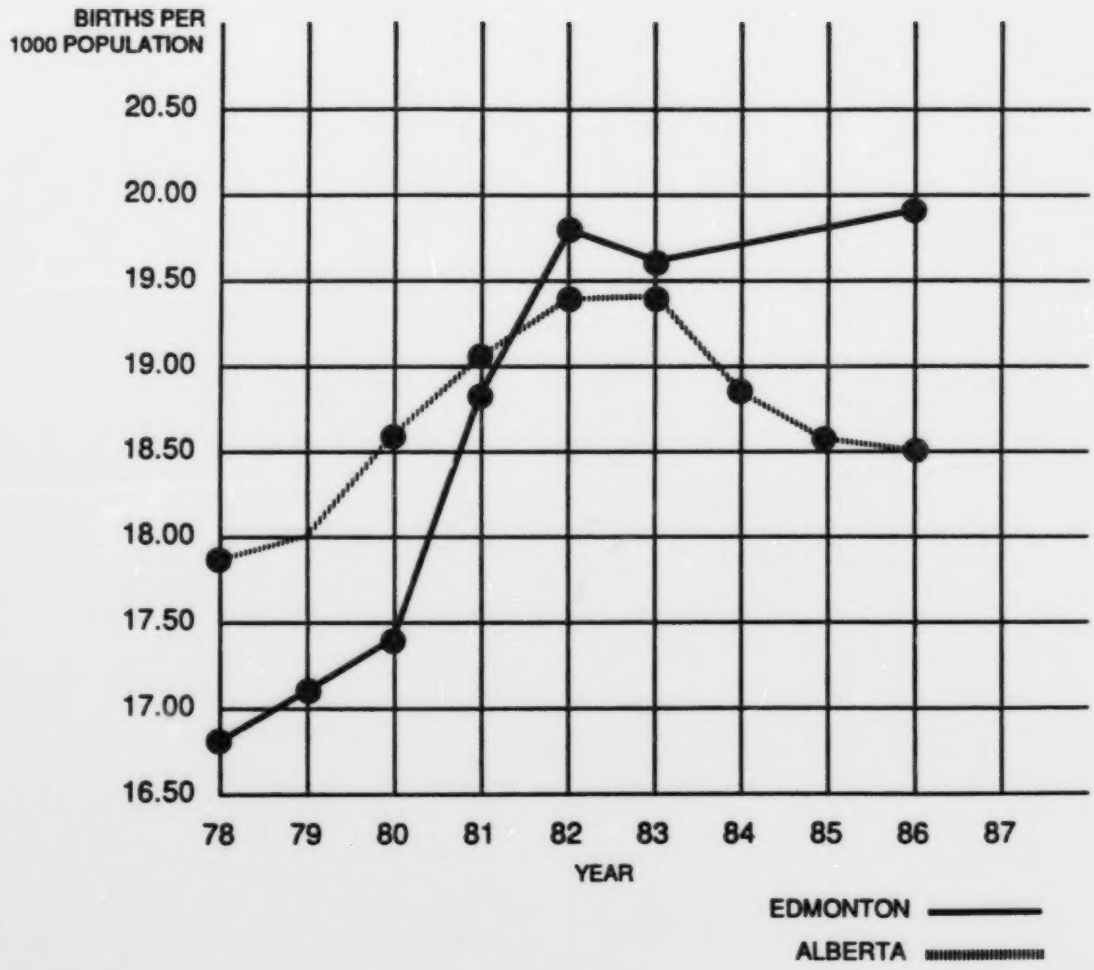

Figure 4: Birth Rates, Edmonton and Alberta, 1978 - 1986

Source: Edmonton Civic Censuses, 1978 - 1986
Alberta Bureau of Statistics

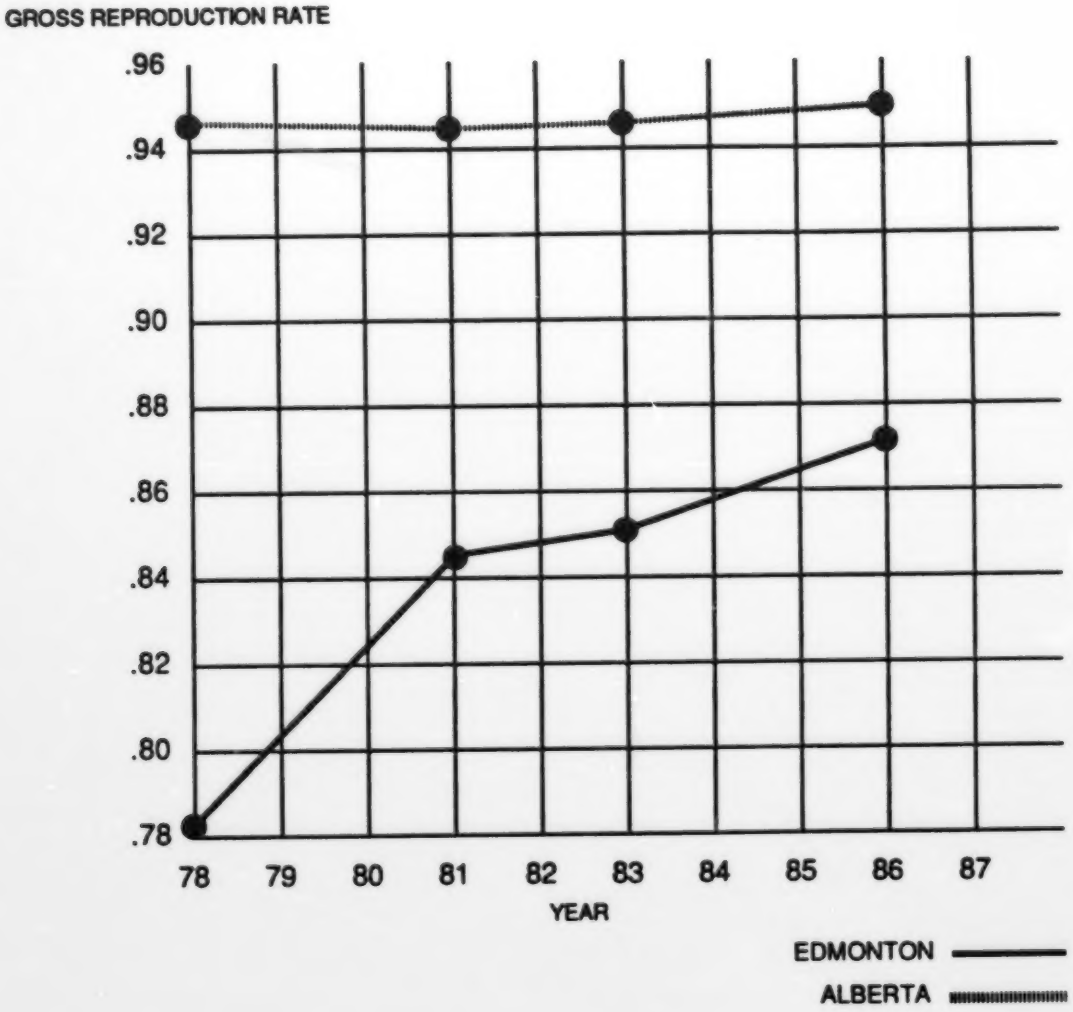

Figure 5: Gross Reproduction, Edmonton and Alberta, 1978 - 1986

Source: Tables 1 and 2

establishment of their professional careers. Hence, both marriage and child bearing would be on the increase in the age group 30-39 when university graduates will have established their career tracks. This proposition is partially supported by the collected data reviewed above. Figure 6, in particular, shows that mean age at childbirth in Edmonton is rising, evidence to the impact of baby-boom offspring-turned-mothers during the recent period. Significant feature of Figure 6 is the substantial increase in mean age at child birth for Edmonton, and parallel significant decrease in same for Alberta. In addition, Figure 7 shows a large rise in the age-specific birth rates for women over 30 in 1987 compared to 1983. Pursuing this speculation further, decline in fertility rates in Edmonton should be expected as female baby-boom offspring begin to exit their fertile ages in their late thirties and early forties. This also conforms to past observations that Edmonton fertility rates, just like those for the rest of Canada, oscillate (City of Edmonton: 1984, p. 135). Assuming that this, indeed, is the case, it is likely that Edmonton fertility rates are reaching their peak or will do so within the next 5-10 years.

The particular purpose of these observations, no matter how qualitative, is to derive numerical fertility assumptions for the demographic database upon which the city's population projections are based. These assumptions must be given in terms of actual birth rates.

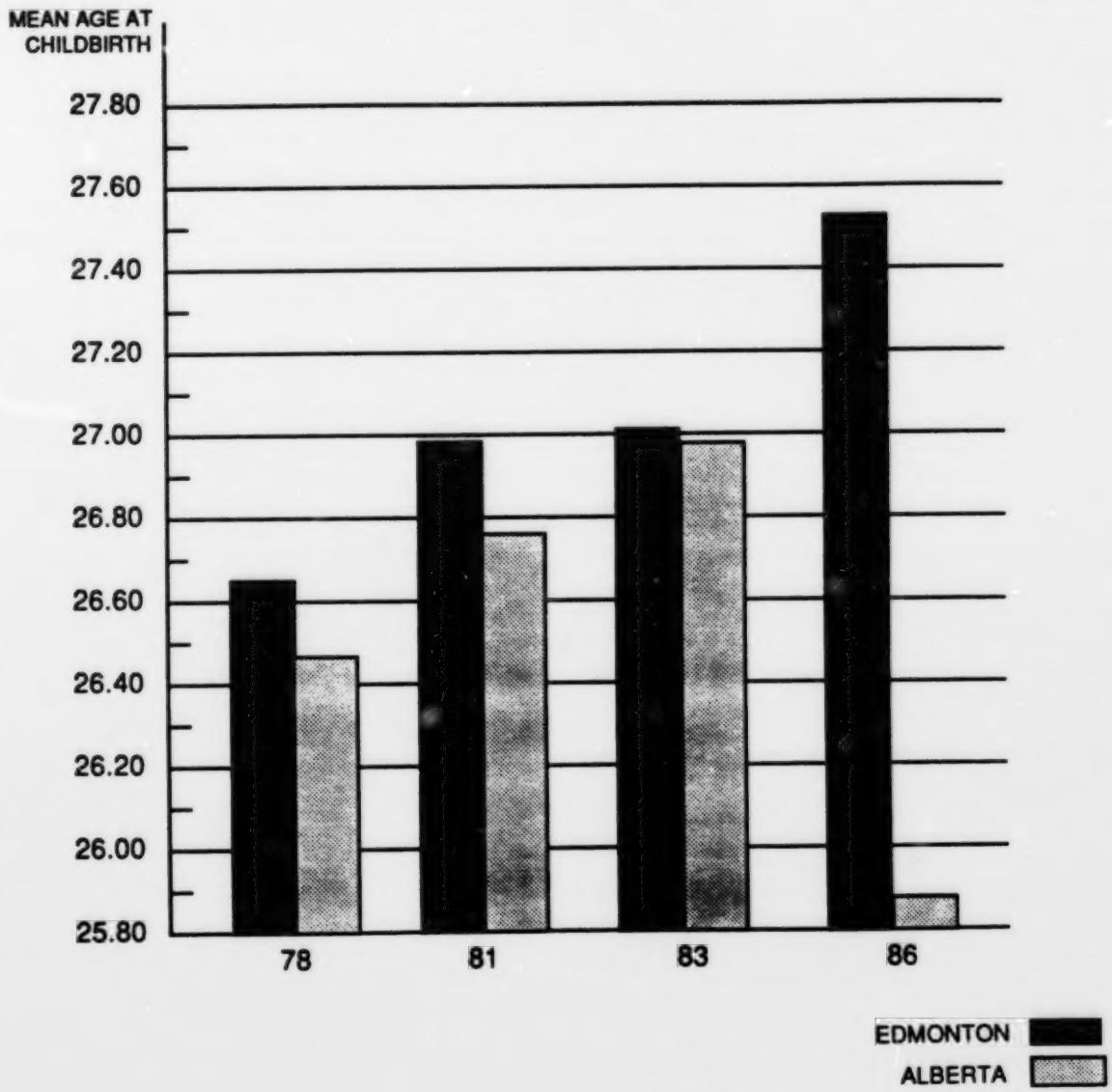

Figure 6: Mean Age at Childbirth, Edmonton and Alberta

Source: Tables 1 and 2

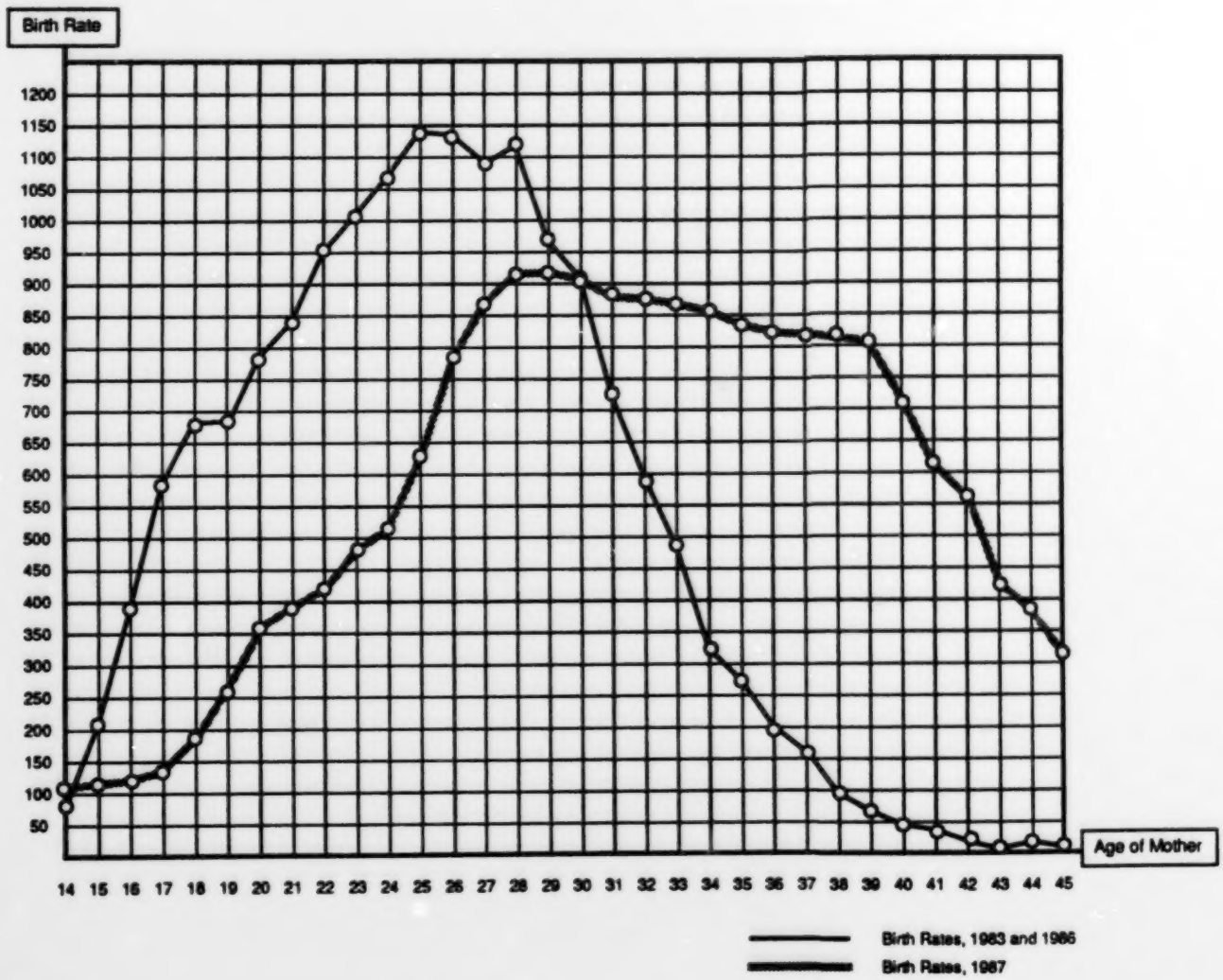

Figure 7: Fertility Assumptions, Edmonton, 1983 / 86, and 1987

Source: Planning and Building Department, 1988

5. Accuracy of Urban Birth Rates

In demographic forecasts of small populations it is important to recognize the problematics related to the database as well as to the accuracy of population projection itself. Generally, the fitness of the data is no less important than the computer program that generates the population projection.

The primary fertility data for the Edmonton demographic database include the number of births for single-year age groups of females. The problem of random variation is acute when considering birth rates in very small groups such as single-year age-groups of Edmonton females. The adjustment of the single-year data is done by smoothing, i.e., grouping into larger age-groups and then splitting back into single-year age-groups. Several computer routines exist and are readily available for the general user (e.g., Arriaga, Anderson and Heligman 1976). The smoothing procedure used for the 1986 Edmonton age-sex specific birth rates, a modified version of a general-purpose smoothing algorithm, uses the 5-year grouped fertility data in Table 1. The smoothed birth rates for Edmonton were further adjusted using judgment and assumptions regarding average fertility throughout 2002. The resulting distribution of the smoothed and adjusted birth-rates of Edmonton appears in Table 3.

The accuracy of the smoothed rates must be considered within the context of its application - the population projection. Whether or not the rates truly reflect Edmonton fertility for 1986 is less important than the question whether these rates reflect the fertility trend in Edmonton throughout the forecast period. We distinguish here between preciseness and accuracy. The presented rates certainly are not the true 1986 fertility rates. However,

TABLE 3 BIRTH-RATES WITHIN SINGLE-YEAR AGE GROUPS OF THOUSAND WOMEN, ALBERTA AND EDMONTON

Age	Alberta 1981	Alberta 1982	Alberta 1983-2011	Edmonton 1987-2002
14			0.0	10.1
15	6.80	7.82	8.18	12.2
16	20.33	19.68	20.59	13.4
17	35.73	37.57	39.30	14.2
18	55.04	57.04	59.66	19.9
19	73.00	74.25	77.67	25.8
20	85.50	83.90	87.76	35.4
21	97.32	99.51	104.09	39.0
22	114.23	114.33	119.59	42.2
23	122,58	123,85	129.55	48.3
24	130.99	129.89	135.86	51.4
25	140.00	135.28	141.50	63.1
26	144.87	141.54	148.05	78.1
27	138.71	134.00	140.16	86.7
28	130.19	127.23	133.08	91.3
29	117.76	122.02	127.63	91.2
30	103.54	108.75	113.75	90.7
31	87.96	91.49	95.70	88.4
32	73.97	74.31	77.73	87.5
33	54.99	58.10	60.77	86.7
34	47.71	45.31	47.39	85.4
35	34.49	36.26	37.93	84.5
36	26.89	28.00	29.29	83.2
37	19.68	21.10	22.07	82.1
38	14.01	15.38	16.09	81.9
39	11.69	9.35	9.78	81.1
40	6.82	8.24	8.62	70.1
41	6.56	4.84	5.06	61.2
42	2.45	3.13	3.27	56.3
43	2.14	3.04	3.18	43.4
44	96	1.20	1.26	39.5
45	.66	.48	.50	31.3
46	.49	.37	.39	21.1
47	.20	.39	.41	10.9
48	.00	.10	.10	3.2
49	.00	.00	.00	0
TFR	1908.28	1917.75	2005.96	1898.0

Source: Alberta Bureau of Statistics, 1986, 1987
Planning and Building Department, 1988
Edmonton Board of Health
Alberta Vital Statistics
Table 1

considering the expected continuing increase in fertility in the next 5-10 years and then gradual fertility decline, the presented rates may be expected to reflect the average rates for the next 15 years.

Consistent with this observation, the adjusted 1986 rates were taken as the appropriate average age-specific fertility rates for the period 1987-2002. These rates were incorporated in the 1987 Edmonton demographic database for further application in population projections.

For the past two decades population projections have been done exclusively as EDP applications. Similar to most other demographic routines available, there are several computer programs that perform population projections (see for example, Keyfitz and Flieger, 1971; Shorter and Pasta, 1974; Arriaga, Anderson and Heligman, 1976).

The distinguishing feature of the program used for Edmonton citywide population forecasts, is that both in its database and in the results it yields, population age-sex distribution is given by single years of age. The program, initially developed by the University of Alberta Population Research Laboratory, was enhanced and modified for the City of Edmonton purposes (Lalu and Akkerman, 1983). Presently, the program yields projection of males and females in intervals of 1-year throughout the forecast. The program output consists of age groups that may be any combination of the single-year age-groups. As a matter of convention the default output is for 5-year age groups. The program is interactive and age groups other than quinquennial may be chosen by the user.

The program, coded CITYWIDE, reads all initial information on fertility, mortality and age distribution from a demographic database such as the one in Table 3. It then reads from a separate data file information relating to assumptions regarding numbers of in- and out-migrants by sex. The program performs a one-year population projection that yields the forecast population age and sex distribution. In an iterative procedure the program then performs identical tasks as in the initial step for all consecutive years.

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987 (continued on next page)

	POPULATION		SURVIVAL RATIOS		DISTRIBUTION OF MIGRANTS				BIRTH RATES
					IN		OUT		
AGE	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	
0	4888.	4819.	0.9454	0.9556	12.	49.	49.	49.	0.0
1	4999.	4766.	0.9991	0.9992	14.	49.	49.	49.	0.0
2	4629.	4587.	0.9997	0.9995	16.	52.	52.	52.	0.0
3	4800.	4525.	0.9996	0.9996	17.	54.	54.	54.	0.0
4	4594.	4242.	0.9991	0.9996	21.	56.	56.	56.	0.0
5	4383.	4124.	0.9997	0.9996	25.	54.	54.	54.	0.0
6	4137.	3874.	0.9994	0.9998	32.	52.	52.	52.	0.0
7	3964.	3762.	0.9997	0.9999	34.	48.	48.	48.	0.0
8	3632.	3437.	0.9997	0.9997	36.	47.	47.	47.	0.0
9	3593.	3309.	0.9997	0.9997	42.	39.	39.	39.	0.0
10	3557.	3477.	0.9999	1.0000	46.	45.	45.	45.	0.0
11	3546.	3416.	0.9998	0.9998	46.	46.	46.	46.	0.0
12	3304.	3223.	0.9996	1.0000	48.	48.	48.	48.	0.0005
13	3358.	3132.	0.9996	0.9999	49.	49.	49.	49.	0.0063
14	3454.	3273.	0.9995	0.9998	43.	43.	43.	43.	0.0101
15	3522.	3194.	0.9997	0.9997	42.	42.	42.	42.	0.0122
16	3766.	3510.	0.9988	0.9992	40.	40.	40.	40.	0.0134
17	3782.	3749.	0.9987	0.9996	45.	45.	45.	45.	0.0142
18	4245.	4402.	0.9983	0.9993	46.	46.	46.	46.	0.0199
19	4738.	5155.	0.9980	0.9995	49.	49.	49.	49.	0.0258
20	5177.	5706.	0.9986	0.9996	51.	51.	51.	51.	0.0354
21	5808.	6180.	0.9986	0.9997	43.	43.	43.	43.	0.0390
22	6303.	6839.	0.9985	0.9996	43.	43.	43.	43.	0.0422
23	6526.	7249.	0.9985	0.9996	44.	44.	44.	44.	0.0483
24	7068.	7429.	0.9987	0.9992	42.	42.	42.	42.	0.0514
25	7019.	7079.	0.9985	0.9993	48.	48.	48.	48.	0.0631
26	7291.	7426.	0.9991	0.9994	49.	49.	49.	49.	0.0781
27	7124.	7050.	0.9986	0.9996	54.	54.	54.	54.	0.0867
28	6968.	6786.	0.9989	0.9996	46.	46.	46.	46.	0.0913
29	7080.	6753.	0.9985	0.9993	46.	46.	46.	46.	0.0912
30	6825.	6304.	0.9987	0.9992	48.	48.	48.	48.	0.0907
31	6280.	6043.	0.9992	0.9993	49.	49.	49.	49.	0.0884
32	6049.	5738.	0.9981	0.9996	51.	51.	51.	51.	0.0875
33	5539.	5364.	0.9984	0.9999	52.	52.	52.	52.	0.0867
34	5475.	5175.	0.9983	0.9991	53.	53.	53.	53.	0.0854
35	4889.	4593.	0.9988	0.9987	53.	53.	53.	53.	0.0845
36	4873.	4499.	0.9982	0.9989	54.	54.	54.	54.	0.0832
37	4595.	4232.	0.9984	0.9986	55.	55.	55.	55.	0.0821
38	4145.	4012.	0.9973	0.9982	53.	53.	53.	53.	0.0819
39	4331.	4167.	0.9974	0.9990	52.	52.	52.	52.	0.0811
40	4069.	3816.	0.9984	0.9991	52.	52.	52.	52.	0.0701
41	3238.	3449.	0.9975	0.9980	52.	52.	52.	52.	0.0612
42	3123.	3123.	0.9975	0.9976	51.	51.	51.	51.	0.0563
43	3070.	3211.	0.9964	0.9975	49.	49.	49.	49.	0.0434
44	3165.	3135.	0.9968	0.9975	48.	48.	48.	48.	0.0395
45	2854.	2943.	0.9971	0.9978	48.	48.	48.	48.	0.0313
46	2866.	2923.	0.9952	0.9974	43.	43.	43.	43.	0.0211
47	2659.	2829.	0.9947	0.9973	47.	47.	47.	47.	0.0109
48	2640.	2631.	0.9948	0.9974	46.	46.	46.	46.	0.0032
49	2706.	2832.	0.9951	0.9972	48.	48.	48.	48.	0.0
50	2644.	2654.	0.9935	0.9970	49.	49.	49.	49.	0.0

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987 (continued on next page)

AGE	POPULATION		SURVIVAL RATIOS		DISTRIBUTION OF MIGRANTS				BIRTH RATES
					IN		OUT		
	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	MALES	FEMALES	
51	2612.	2671.	0.9935	0.9968	43.	43.	43.	43.	0.0
52	2520.	2557.	0.9915	0.9966	47.	47.	47.	47.	0.0
53	2448.	2444.	0.9924	0.9964	48.	48.	48.	48.	0.0
54	2591.	2596.	0.9900	0.9959	43.	43.	43.	43.	0.0
55	2491.	2441.	0.9893	0.9958	80.	80.	80.	80.	0.0
56	2594.	2586.	0.9877	0.9951	64.	64.	64.	64.	0.0
57	2585.	2407.	0.9885	0.9948	48.	48.	48.	48.	0.0
58	2352.	2475.	0.9861	0.9929	31.	49.	31.	49.	0.0
59	2343.	2416.	0.9856	0.9912	24.	50.	24.	50.	0.0
60	2123.	2290.	0.9854	0.9886	11.	51.	11.	51.	0.0
61	2030.	2269.	0.9825	0.9865	10.	53.	10.	53.	0.0
62	1958.	2131.	0.9820	0.9854	24.	54.	24.	54.	0.0
63	1866.	2081.	0.9818	0.9833	22.	55.	22.	55.	0.0
64	1875.	2178.	0.9813	0.9822	26.	56.	26.	56.	0.0
65	1847.	2195.	0.9801	0.9810	20.	53.	20.	53.	0.0
66	1732.	2044.	0.9760	0.9791	19.	47.	19.	47.	0.0
67	1506.	1883.	0.9774	0.9782	16.	41.	16.	41.	0.0
68	1247.	1617.	0.9764	0.9772	6.	36.	6.	36.	0.0
69	1219.	1522.	0.9761	0.9761	5.	30.	5.	30.	0.0
70	1157.	1498.	0.9760	0.9760	24.	24.	24.	24.	0.0
71	1117.	1500.	0.9731	0.9753	19.	19.	19.	19.	0.0
72	1090.	1458.	0.9719	0.9751	10.	13.	10.	13.	0.0
73	931.	1351.	0.9698	0.9743	3.	17.	3.	17.	0.0
74	879.	1206.	0.9631	0.9712	16.	17.	16.	17.	0.0
75	742.	1185.	0.9595	0.9685	13.	14.	13.	14.	0.0
76	762.	1130.	0.9515	0.9613	7.	14.	7.	14.	0.0
77	669.	1013.	0.9454	0.9586	6.	14.	6.	14.	0.0
78	616.	987.	0.9431	0.9571	4.	14.	4.	14.	0.0
79	600.	896.	0.9412	0.9507	4.	14.	4.	14.	0.0
80	473.	779.	0.9305	0.9492	4.	5.	4.	5.	0.0
81	463.	758.	0.9249	0.9411	3.	17.	3.	17.	0.0
82	419.	696.	0.9100	0.9376	6.	19.	6.	19.	0.0
83	367.	611.	0.9012	0.9249	2.	11.	2.	11.	0.0
84	305.	557.	0.9001	0.9201	10.	13.	10.	13.	0.0
85	262.	491.	0.8771	0.9131	11.	15.	11.	15.	0.0
86	225.	441.	0.8691	0.8901	1.	12.	1.	12.	0.0
87	173.	305.	0.8542	0.8865	1.	12.	1.	12.	0.0
88	106.	260.	0.8437	0.8653	1.	12.	1.	12.	0.0
89	106.	199.	0.8310	0.8487	1.	12.	1.	12.	0.0
90	358.	930.	0.8142	0.8231	1.	12.	1.	12.	0.0
	285049.	291200.			2956.	3720.	3206.	3720.	

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1987

AGE	TOTAL	MALE	FEMALE
0 - 4	46849.	23910.	22939.
5 - 9	38215.	19709.	18506.
10 - 14	33740.	17219.	16521.
15 - 19	40063.	20053.	20010.
20 - 24	64285.	30882.	33403.
25 - 29	70576.	35482.	35094.
30 - 34	58792.	30168.	28624.
35 - 39	44336.	22833.	21503.
40 - 44	33399.	16665.	16734.
45 - 49	27883.	13725.	14158.
50 - 54	25737.	12815.	12922.
55 - 59	24690.	12365.	12325.
60 - 64	20801.	9852.	10949.
65 - 69	16812.	7551.	9261.
70 - 74	12187.	5174.	7013.
75 - 79	8600.	3389.	5211.
80 - 84	5428.	2027.	3401.
85+	3856.	1230.	2626.
TOTAL	576249.	285049.	291200.

SELECTED AGE-GROUPS, 1987

AGE	TOTAL	MALE	FEMALE
15 - 49	339334.	169808.	169526.

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1988

AGE	TOTAL	MALE	FEMALE
0 - 4	46882.	23474.	23408.
5 - 9	39687.	20306.	19381.
10 - 14	33898.	17392.	16506.
15 - 19	36842.	18771.	18072.
20 - 24	59604.	28538.	31066.
25 - 29	71152.	35454.	35698.
30 - 34	61888.	31758.	30131.
35 - 39	46387.	23963.	22424.
40 - 44	35491.	17815.	17676.
45 - 49	28521.	14147.	14374.
50 - 54	25920.	12857.	13063.
55 - 59	24854.	12485.	12368.
60 - 64	21118.	10152.	10966.
65 - 69	17687.	8030.	9657.
70 - 74	12484.	5363.	7121.
75 - 79	8768.	3485.	5283.
80 - 84	5614.	2128.	3487.
85+	4036.	1302.	2734.
TOTAL	580830.	287418.	293412.

SELECTED AGE-GROUPS, 1988

AGE	TOTAL	MALE	FEMALE
15 - 49	339885.	170445.	169440.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	14000.	13500.	27500.
OUT-MIGRANTS	14800.	14300.	29100.
NET-MIGRANTS	-800.	-800.	-1600.
BIRTHS	5196.	4992.	10188.
DEATHS	1810.	1920.	3730.
NAT. INCREASE	3385.	3072.	6457.
POP. INCREASE	2369.	2212.	4581.

CRUDE BIRTH RATE: 0.018
GENERAL FERTILITY RATE: 0.030
CRUDE DEATH RATE: 0.006

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1989

AGE	TOTAL	MALE	FEMALE
0 - 4	46877.	23134.	23744.
5 - 9	41432.	20972.	20460.
10 - 14	34550.	17741.	16810.
15 - 19	34744.	17949.	16795.
20 - 24	54515.	26306.	28208.
25 - 29	71201.	35061.	36141.
30 - 34	64767.	33231.	31536.
35 - 39	49153.	25410.	23744.
40 - 44	37380.	18937.	18443.
45 - 49	29516.	14601.	14915.
50 - 54	26253.	13047.	13206.
55 - 59	24806.	12530.	12276.
60 - 64	21700.	10490.	11209.
65 - 69	18377.	8478.	9899.
70 - 74	12738.	5543.	7195.
75 - 79	9052.	3623.	5429.
80 - 84	5799.	2184.	3615.
85+	4235.	1389.	2846.
TOTAL	587090.	290622.	296468.

SELECTED AGE-GROUPS, 1989

AGE	TOTAL	MALE	FEMALE
15 - 49	341274.	171494.	169780.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	14300.	13700.	28000.
OUT-MIGRANTS	14300.	13700.	28000.
NET-MIGRANTS	0.	0.	0.
BIRTHS	5290.	5083.	10373.
DEATHS	1868.	1968.	3835.
NAT. INCREASE	3422.	3115.	6537.
POP. INCREASE	3204.	3056.	6260.

CRUDE BIRTH RATE: 0.018
GENERAL FERTILITY RATE: 0.030
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1990

AGE	TOTAL	MALE	FEMALE
0 - 4	47344.	23232.	24112.
5 - 9	42368.	21071.	21297.
10 - 14	35839.	18475.	17364.
15 - 19	33880.	17599.	16281.
20 - 24	49030.	23902.	25128.
25 - 29	70279.	34349.	35930.
30 - 34	67262.	34415.	32847.
35 - 39	52232.	26987.	25245.
40 - 44	40052.	20516.	19536.
45 - 49	30338.	15151.	15187.
50 - 54	26704.	13248.	13455.
55 - 59	24900.	12508.	12392.
60 - 64	22358.	10985.	11373.
65 - 69	18737.	8782.	9955.
70 - 74	13250.	5829.	7420.
75 - 79	9525.	3869.	5656.
80 - 84	5941.	2244.	3697.
85+	4453.	1478.	2975.
TOTAL	594487.	294639.	299848.

SELECTED AGE-GROUPS, 1990

AGE	TOTAL	MALE	FEMALE
15 - 49	343073.	172919.	170153.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	14800.	13800.	28600.
OUT-MIGRANTS	14000.	13500.	27500.
NET-MIGRANTS	800.	300.	1100.
BIRTHS	5371.	5161.	10532.
DEATHS	1937.	2021.	3957.
NAT. INCREASE	3435.	3140.	6575.
POP. INCREASE	4017.	3380.	7397.

CRUDE BIRTH RATE: 0.018
GENERAL FERTILITY RATE: 0.031
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(continued on next page)

5-YEAR AGE-GROUPS, 1991

AGE	TOTAL	MALE	FEMALE
0 - 4	47539.	23168.	24371.
5 - 9	43503.	21289.	22214.
10 - 14	36930.	19081.	17849.
15 - 19	33746.	17535.	16211.
20 - 24	44490.	22008.	22482.
25 - 29	67703.	33002.	34701.
30 - 34	69800.	35560.	34240.
35 - 39	55338.	28538.	26800.
40 - 44	42867.	22282.	20585.
45 - 49	31342.	15641.	15701.
50 - 54	27291.	13594.	13697.
55 - 59	25073.	12606.	12467.
60 - 64	23044.	11437.	11607.
65 - 69	18970.	8955.	10015.
70 - 74	14043.	6293.	7750.
75 - 79	9881.	4061.	5820.
80 - 84	6168.	2342.	3826.
85+	4657.	1558.	3099.
TOTAL	602381.	298948.	303433.

SELECTED AGE-GROUPS, 1991

AGE	TOTAL	MALE	FEMALE
15 - 49	345285.	174565.	170720.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	15200.	14100.	29300.
OUT-MIGRANTS	14100.	13600.	27700.
NET-MIGRANTS	1100.	500.	1600.
BIRTHS	5435.	5222.	10658.
DEATHS	2012.	2087.	4099.
NAT. INCREASE	3423.	3136.	6559.
POP. INCREASE	4308.	3585.	7894.

CRUDE BIRTH RATE: 0.018
GENERAL FERTILITY RATE: 0.031
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1992

AGE	TOTAL	MALE	FEMALE
0 - 4	48035.	23410.	24625.
5 - 9	44047.	21101.	22947.
10 - 14	38356.	19823.	18533.
15 - 19	34286.	17755.	16531.
20 - 24	40537.	20528.	20009.
25 - 29	64678.	31320.	33358.
30 - 34	70954.	35915.	35039.
35 - 39	59175.	30640.	28536.
40 - 44	44647.	23269.	21378.
45 - 49	33562.	16992.	16570.
50 - 54	27910.	13921.	13988.
55 - 59	25556.	12868.	12688.
60 - 64	23438.	11733.	11704.
65 - 69	19107.	9122.	9985.
70 - 74	15017.	6808.	8209.
75 - 79	10241.	4303.	5938.
80 - 84	6383.	2408.	3975.
85+	4806.	1613.	3193.
TOTAL	610732.	303527.	307205.

SELECTED AGE-GROUPS, 1992

AGE	TOTAL	MALE	FEMALE
15 - 49	347839.	176418.	171421.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	15600.	14400.	30000.
OUT-MIGRANTS	14200.	13700.	27900.
NET-MIGRANTS	1400.	700.	2100.
BIRTHS	5480.	5265.	10745.
DEATHS	2088.	2151.	4239.
NAT. INCREASE	3391.	3114.	6506.
POP. INCREASE	4580.	3772.	8352.

CRUDE BIRTH RATE: 0.018
GENERAL FERTILITY RATE: 0.031
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(continued on next page)

5-YEAR AGE-GROUPS, 1993

AGE	TOTAL	MALE	FEMALE
0 - 4	48637.	23698.	24939.
5 - 9	44300.	20772.	23528.
10 - 14	40090.	20584.	19506.
15 - 19	34714.	18101.	16613.
20 - 24	37605.	19432.	18173.
25 - 29	60290.	29166.	31124.
30 - 34	71820.	36075.	35746.
35 - 39	62563.	32417.	30146.
40 - 44	46994.	24588.	22406.
45 - 49	35914.	18309.	17605.
50 - 54	28809.	14508.	14301.
55 - 59	26045.	13107.	12938.
60 - 64	23814.	11957.	11857.
65 - 69	19575.	9468.	10108.
70 - 74	15899.	7276.	8623.
75 - 79	10545.	4491.	6054.
80 - 84	6545.	2494.	4051.
85+	5037.	1712.	3326.
TOTAL	619194.	308152.	311042.

SELECTED AGE-GROUPS, 1993

AGE	TOTAL	MALE	FEMALE
15 - 49	349900.	178087.	171813.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5501.	5286.	10787.
DEATHS	2170.	2215.	4385.
NAT. INCREASE	3331.	3071.	6402.
POP. INCREASE	4625.	3837.	8462.

CRUDE BIRTH RATE: 0.017
GENERAL FERTILITY RATE: 0.031
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1994

AGE	TOTAL	MALE	FEMALE
0 - 4	49031.	23885.	25147.
5 - 9	44396.	20476.	23920.
10 - 14	41986.	21352.	20634.
15 - 19	35528.	18564.	16964.
20 - 24	35682.	18734.	16948.
25 - 29	55387.	27064.	28323.
30 - 34	72047.	35808.	36239.
35 - 39	65610.	34010.	31600.
40 - 44	49925.	26153.	23772.
45 - 49	37947.	19532.	18415.
50 - 54	29948.	15065.	14883.
55 - 59	26547.	13414.	13133.
60 - 64	23901.	12079.	11822.
65 - 69	20201.	9820.	10382.
70 - 74	16563.	7697.	8866.
75 - 79	10788.	4657.	6131.
80 - 84	6777.	2601.	4176.
85+	5254.	1786.	3468.
TOTAL	627514.	312693.	314821.

SELECTED AGE-GROUPS, 1994

AGE	TOTAL	MALE	FEMALE
15 - 49	352126.	179865.	172261.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5498.	5282.	10780.
DEATHS	2256.	2279.	4535.
NAT. INCREASE	3242.	3003.	6244.
POP. INCREASE	4541.	3779.	8320.

CRUDE BIRTH RATE: 0.017
GENERAL FERTILITY RATE: 0.031
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(continued on next page)

5-YEAR AGE-GROUPS, 1995

AGE	TOTAL	MALE	FEMALE
0 - 4	49215.	23969.	25246.
5 - 9	44893.	20570.	24324.
10 - 14	42996.	21495.	21501.
15 - 19	36901.	19352.	17548.
20 - 24	34911.	18445.	16466.
25 - 29	50014.	24732.	25282.
30 - 34	71223.	35161.	36061.
35 - 39	68188.	35249.	32939.
40 - 44	53075.	27778.	25296.
45 - 49	40668.	21142.	19526.
50 - 54	30835.	15653.	15182.
55 - 59	27079.	13668.	13411.
60 - 64	24064.	12099.	11965.
65 - 69	20852.	10291.	10561.
70 - 74	16912.	7977.	8935.
75 - 79	11247.	4909.	6338.
80 - 84	7138.	2782.	4356.
85+	5438.	1858.	3580.
TOTAL	635645.	317128.	318517.

SELECTED AGE-GROUPS, 1995

AGE	TOTAL	MALE	FEMALE
15 - 49	354979.	181860.	173119.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5471.	5256.	10727.
DEATHS	2343.	2346.	4689.
NAT. INCREASE	3127.	2910.	6038.
POP. INCREASE	4435.	3697.	8132.

CRUDE BIRTH RATE: 0.017
GENERAL FERTILITY RATE: 0.030
CRUDE DEATH RATE: 0.007

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(continued on next page)

5-YEAR AGE-GROUPS, 1996

AGE	TOTAL	MALE	FEMALE
0 - 4	49189.	23951.	25238.
5 - 9	45096.	20493.	24603.
10 - 14	44171.	21735.	22437.
15 - 19	38041.	19991.	18051.
20 - 24	34829.	18415.	16415.
25 - 29	45544.	22883.	22662.
30 - 34	68714.	33859.	34855.
35 - 39	70767.	36421.	34345.
40 - 44	56211.	29350.	26861.
45 - 49	43491.	22909.	20582.
50 - 54	31869.	16162.	15707.
55 - 59	27701.	14033.	13668.
60 - 64	24279.	12218.	12061.
65 - 69	21506.	10711.	10795.
70 - 74	17139.	8137.	9002.
75 - 79	11931.	5302.	6629.
80 - 84	7408.	2922.	4487.
85+	5664.	1945.	3719.
TOTAL	643547.	321433.	322113.

SELECTED AGE-GROUPS, 1996

AGE	TOTAL	MALE	FEMALE
15 - 49	357598.	183827.	173771.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5423.	5210.	10633.
DEATHS	2433.	2412.	4846.
NAT. INCREASE	2989.	2798.	5787.
POP. INCREASE	4305.	3596.	7901.

CRUDE BIRTH RATE: 0.017
GENERAL FERTILITY RATE: 0.030
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(continued on next page)

5-YEAR AGE-GROUPS, 1997

AGE	TOTAL	MALE	FEMALE
0 - 4	48959.	23833.	25126.
5 - 9	45581.	20717.	24864.
10 - 14	44723.	21548.	23175.
15 - 19	39480.	20740.	18740.
20 - 24	35384.	18643.	16741.
25 - 29	41623.	21422.	20201.
30 - 34	65721.	32198.	33523.
35 - 39	71931.	36784.	35146.
40 - 44	60029.	31439.	28589.
45 - 49	45260.	23888.	21372.
50 - 54	34053.	17484.	16569.
55 - 59	28313.	14354.	13959.
60 - 64	24747.	12470.	12276.
65 - 69	21867.	10979.	10888.
70 - 74	17269.	8288.	8981.
75 - 79	12748.	5725.	7023.
80 - 84	7661.	3086.	4575.
85+	5839.	1995.	3845.
TOTAL	651181.	325590.	325591.

SELECTED AGE-GROUPS, 1997

AGE	TOTAL	MALE	FEMALE
15 - 49	359426.	185114.	174312.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5357.	5147.	10505.
DEATHS	2524.	2477.	5001.
NAT. INCREASE	2833.	2670.	5503.
POP. INCREASE	4157.	3478.	7634.

CRUDE BIRTH RATE: 0.016
GENERAL FERTILITY RATE: 0.029
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1998

AGE	TOTAL	MALE	FEMALE
0 - 4	48543.	23622.	24921.
5 - 9	46181.	21004.	25177.
10 - 14	44975.	21220.	23756.
15 - 19	41210.	21498.	19711.
20 - 24	35809.	18986.	16822.
25 - 29	38703.	20333.	18370.
30 - 34	61354.	30058.	31296.
35 - 39	72792.	36943.	35849.
40 - 44	63383.	33196.	30188.
45 - 49	47572.	25184.	22388.
50 - 54	36353.	18764.	17589.
55 - 59	29180.	14914.	14266.
60 - 64	25210.	12692.	12517.
65 - 69	22208.	11181.	11027.
70 - 74	17685.	8593.	9091.
75 - 79	13467.	6099.	7368.
80 - 84	7871.	3214.	4657.
85+	6027.	2083.	3943.
TOTAL	658518.	329582.	328936.

SELECTED AGE-GROUPS, 1998

AGE	TOTAL	MALE	FEMALE
15 - 49	360822.	186197.	174625.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5278.	5071.	10349.
DEATHS	2620.	2546.	5166.
NAT. INCREASE	2657.	2525.	5182.
POP. INCREASE	3992.	3345.	7337.

CRUDE BIRTH RATE: 0.016
GENERAL FERTILITY RATE: 0.029
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 1999

AGE	TOTAL	MALE	FEMALE
0 - 4	47966.	23329.	24637.
5 - 9	46575.	21190.	25384.
10 - 14	45071.	20923.	24148.
15 - 19	43100.	22262.	20837.
20 - 24	36619.	19446.	17173.
25 - 29	36789.	19640.	17149.
30 - 34	56473.	27970.	28503.
35 - 39	73016.	36677.	36339.
40 - 44	66398.	34770.	31629.
45 - 49	50456.	26718.	23737.
50 - 54	38334.	19948.	18386.
55 - 59	30275.	15441.	14834.
60 - 64	25672.	12975.	12697.
65 - 69	22282.	11287.	10995.
70 - 74	18237.	8903.	9334.
75 - 79	13987.	6426.	7562.
80 - 84	8039.	3325.	4714.
85+	6253.	2170.	4084.
TOTAL	665537.	333397.	332140.

SELECTED AGE-GROUPS, 1999

AGE	TOTAL	MALE	FEMALE
15 - 49	362849.	187482.	175367.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5188.	4985.	10173.
DEATHS	2717.	2615.	5332.
NAT. INCREASE	2471.	2369.	4840.
POP. INCREASE	3815.	3204.	7019.

CRUDE BIRTH RATE: 0.015
GENERAL FERTILITY RATE: 0.028
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(continued on next page)

5-YEAR AGE-GROUPS, 2000

AGE	TOTAL	MALE	FEMALE
0 - 4	47260.	22971.	24289.
5 - 9	46758.	21274.	25484.
10 - 14	45568.	21017.	24551.
15 - 19	44107.	22404.	21703.
20 - 24	37984.	20228.	17755.
25 - 29	36020.	19352.	16668.
30 - 34	51124.	25653.	25470.
35 - 39	72197.	36035.	36162.
40 - 44	68950.	35993.	32957.
45 - 49	53557.	28314.	25243.
50 - 54	40987.	21506.	19481.
55 - 59	31123.	15998.	15125.
60 - 64	26169.	13209.	12959.
65 - 69	22430.	11306.	11124.
70 - 74	18810.	9318.	9492.
75 - 79	14260.	6646.	7614.
80 - 84	8388.	3509.	4879.
85+	6539.	2298.	4241.
TOTAL	672227.	337029.	335197.

SELECTED AGE-GROUPS, 2000

AGE	TOTAL	MALE	FEMALE
15 - 49	363938.	187979.	175959.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	5091.	4892.	9983.
DEATHS	2814.	2681.	5495.
NAT. INCREASE	2277.	2211.	4488.
POP. INCREASE	3632.	3057.	6690.

CRUDE BIRTH RATE: 0.015
GENERAL FERTILITY RATE: 0.027
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002

(concluded on next page)

5-YEAR AGE-GROUPS, 2001

AGE	TOTAL	MALE	FEMALE
0 - 4	46451.	22561.	23890.
5 - 9	46732.	21257.	25476.
10 - 14	45771.	20941.	24830.
15 - 19	45279.	22642.	22637.
20 - 24	39118.	20862.	18256.
25 - 29	35939.	19322.	16617.
30 - 34	46674.	23816.	22858.
35 - 39	69703.	34743.	34960.
40 - 44	71503.	37151.	34352.
45 - 49	56645.	29857.	26789.
50 - 54	43734.	23214.	20520.
55 - 59	32119.	16480.	15639.
60 - 64	26753.	13548.	13205.
65 - 69	22630.	11415.	11214.
70 - 74	19385.	9686.	9699.
75 - 79	14447.	6775.	7671.
80 - 84	8901.	3792.	5109.
85+	6789.	2408.	4381.
TOTAL	678568.	340467.	338101.

SELECTED AGE-GROUPS, 2001

AGE	TOTAL	MALE	FEMALE
15 - 49	364861.	188392.	176469.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	4988.	4792.	9781.
DEATHS	2916.	2750.	5666.
NAT. INCREASE	2072.	2042.	4114.
POP. INCREASE	3438.	2904.	6342.

CRUDE BIRTH RATE: 0.014
GENERAL FERTILITY RATE: 0.027
CRUDE DEATH RATE: 0.008

TABLE 4 POPULATION PROJECTION, EDMONTON, 1987-2002
(concluded)

5-YEAR AGE-GROUPS, 2002

AGE	TOTAL	MALE	FEMALE
0 - 4	45566.	22112.	23454.
5 - 9	46503.	21139.	25364.
10 - 14	46255.	21164.	25091.
15 - 19	45829.	22455.	23374.
20 - 24	40549.	21605.	18944.
25 - 29	36491.	19548.	16942.
30 - 34	42770.	22365.	20404.
35 - 39	66728.	33095.	33633.
40 - 44	72655.	37509.	35145.
45 - 49	60402.	31906.	28495.
50 - 54	45460.	24162.	21298.
55 - 59	34221.	17738.	16483.
60 - 64	27326.	13846.	13480.
65 - 69	23052.	11643.	11409.
70 - 74	19698.	9918.	9780.
75 - 79	14559.	6901.	7658.
80 - 84	9504.	4091.	5413.
85+	6990.	2509.	4482.
TOTAL	684553.	343706.	340847.

SELECTED AGE-GROUPS, 2002

AGE	TOTAL	MALE	FEMALE
15 - 49	365423.	188484.	176938.

ANNUAL POPULATION CHANGE SUMMARY

	MALES	FEMALES	TOTAL
IN-MIGRANTS	16100.	14900.	31000.
OUT-MIGRANTS	14600.	14100.	28700.
NET-MIGRANTS	1500.	800.	2300.
BIRTHS	4882.	4691.	9573.
DEATHS	3019.	2819.	5838.
NAT. INCREASE	1863.	1872.	3735.
POP. INCREASE	3238.	2746.	5985.

CRUDE BIRTH RATE: 0.014
GENERAL FERTILITY RATE: 0.026
CRUDE DEATH RATE: 0.009

6. Fertility Trends and Population Forecasts, Edmonton, 1978-2002

Two major trends in Edmonton demography, mutually related, can be identified. The one is that although Edmonton's natural population growth is presently positive, the fastest population increase is occurring in old age groups. This trend will catch-up with Edmonton, as with most other Canadian cities, and if no continuous influx of net-immigration will occur, decline in Edmonton's population should be expected within the next 30 years.

The other, related feature, is that although Edmonton fertility indicators have shown consistent increase in the past decade the reproductive behaviour of the population puts presently Edmonton's natural growth below replacement level. Figures 4 and 5 illustrate these trends. Net reproduction rate is rising, but still below 1 which is the replacement level for females. Number of births in Edmonton is increasing presently (8,053 in 1978 versus 10,810 in 1986) but the crude birth rate (births per 1,000 population) is decreasing with the rapid rise in numbers of persons in post-reproductive ages. The forecast in Table 4 shows that the number of live births in Edmonton will keep increasing but it will start declining as soon as 1994, at which time the number of births is expected to be 10,780 (see also Planning and Building Department, 1988). The crude birth rate calculated on the basis of the 1987 civic census is 18, but it is expected to decline to 15 live births per thousand at the turn of the century. Accordingly, also the numbers in age-group 0-4 will start declining around 1996. On the other hand the number of persons 70+ shows consistent increase throughout the forecast.

A comparison between the present and past CITYWIDE forecasts for Edmonton (Planning and Building Department, 1986, 1988) and with the provincial forecast for Alberta (Alberta Bureau of Statistics, 1987) sheds further light on the expected trends in fertility and population growth. The previous CITYWIDE forecast for Edmonton was based on 1983 fertility rates. The 1983 fertility assumptions had been adopted throughout 1986 and the respective population forecasts were eventually adopted as official by the City administration (Planning Department, 1984; Planning and Building Department, 1986). Figure 7 is a comparison between the 1983/86 and the 1987 fertility assumptions. The 1987 fertility rates are lower overall and peak at later ages, more gradually and for a longer span, than the 1983/86 rates. The forecasting results of the two sets of assumptions are summarized in Figure 8 for age groups 0-4 and 5-9. The progressive differences in the age group 0-4 between the two forecasts reach their peak around 1996, almost 50,000 in the 1987 forecast versus just under 43,000 in the 1986 forecast. These differences in the two forecasts become smaller with older age groups where the effect of changing birth rates is deferred and blurred by other factors such as migration.

Additional instrumental comparison is between Alberta provincial rates and the Edmonton rates. Table 3 is a comparison between provincial fertility rates assumed by the Alberta Bureau of Statistics for 1983 throughout 2011, and the smoothed adjusted rates for Edmonton, 1986-2001. The assumed provincial birth rates are overall higher than those for Edmonton. However, in accordance with the "baby-boom" assumption of postponement of urban births presented above, age specific birth rates for women in their late thirties are higher for Edmonton.

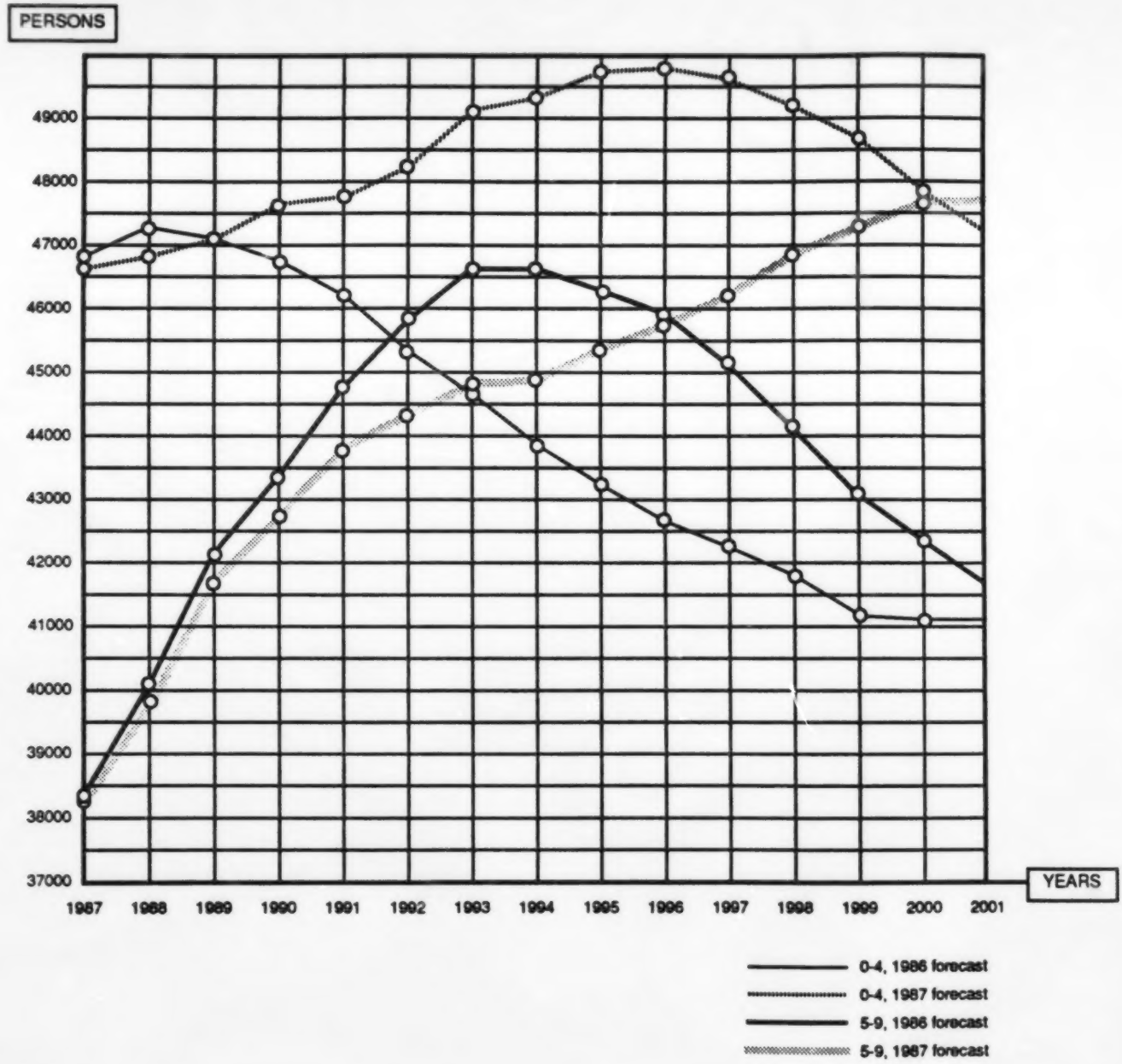

Figure 8: Comparison Between 1986 and 1987 Forecasts for Age-Groups 0-4 and 5-9.
Source: Planning and Building Department, 1988

Some of the differences in the two sets of birth-rate assumptions can be explained by differences between urban and rural fertility, the latter comprising almost half of the provincial rate. However, the underlying difference is grounded in different beliefs regarding the future progress in birth rates. Certainly, the Edmonton assumption appears more conservative than the provincial one. The total fertility rate for Alberta is assumed to increase to 2.005 from just over 1.900 in the early 1980s. The TFR for Edmonton, as well, is assumed to slightly increase from its present level averaging 1.9 between 1986 and 2001.

According to Statistics Canada, the country's total fertility rate may fluctuate anywhere between 1.40 and 2.20 by 1996 (Statistics Canada, 1985). Canada's present TFR is about 1.68 and slightly increasing. The TFR choice of 1.9 implying somewhat increasing fertility in young women seems to conform to recent trends as reviewed here, as well as to the observation of birth postponement among Edmonton women.

For comparison, provincial forecasts for Alberta by Alberta Bureau of Statistics and by Statistics Canada are given in Table 5. The forecasts reflect seven different scenarios (two by Alberta Bureau of Statistics and five by Statistics Canada). In comparison to forecasts of the province, Edmonton's population is expected to have slightly higher percentage of children and a slightly higher percentage of seniors.

TABLE 5

POPULATION FORECASTS FOR ALBERTA, 2001,
ALBERTA BUREAU OF STATISTICS AND STATISTICS CANADA

	ABS I		ABS II		Statistics Canada 1		Statistics Canada 2		Statistics Canada 3		Statistics Canada 4		Statistics Canada 5	
	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%	'000	%
0-14	540.1	17.7	573.1	20.1	445.8	17.7	544.5	18.0	657.0	20.9	558.3	20.9	758.5	23.3
15-24	406.8	14.7	428.4	15.0	370.3	14.7	442.9	14.7	446.6	14.2	382.5	14.3	450.1	13.8
25-44	862.9	32.5	935.0	32.8	816.4	32.5	1,032.9	34.2	1,033.0	32.9	846.6	31.7	1,041.7	32.0
45-64	631.5	23.8	644.9	22.6	598.5	23.8	691.1	22.9	691.2	11.0	601.0	22.5	697.9	21.4
65+	270.6	11.3	270.9	9.5	283.5	11.3	310.9	10.3	310.9	9.9	282.4	10.6	311.1	9.5
TOTAL	2,711.7	100.0	2,852.9	100.0	2,514.4	100.0	3,022.3	100.0	3,138.7	100.0	2,670.8	100.0	3,259.2	100.0

Sources:

Alberta Bureau of Statistics, 1987
Statistics Canada, 1986

7. Conclusion

Demographic data sources of Edmonton enable a thorough analysis of population growth components, fertility in particular. Demographic indicators for the past decade show that fertility in Edmonton has been rising consistently and stronger than the provincial fertility. The increase in fertility, however, appears to be temporal. Birth rates are expected to continue to rise for the next 5 - 10 years in late reproductive ages, but they will likely decline after that period and across all age groups. Even with the present rise in fertility, Edmonton population growth is below replacement level. Although births outnumber deaths, births will begin to decline within the next 10 years, and deaths will outnumber births within the next 30 years. By the year 2001 the total population of Edmonton is expected to be in the vicinity of 680,000. Children 0-14 will account for 22% of the population, and persons 65+ will account for 13% of the population compared to 21% and 8% respectively, in 1987.

The demographic computer routines for age-distribution smoothing and for single-year population projections that were applied here for Edmonton, illustrate both the necessity for and the potential of computer programs that are unique for demographic urban analysis. Computer applications in urban demography are still at their early stage. This paper presents the importance of this newly emerging discipline to the understanding of urban growth, and as a means for a significant information input to the process of urban planning.

The expected decline of urban populations throughout Canada, not only in Edmonton, stresses the importance of careful adoption of demographic forecasting techniques, and may prove an important emerging discipline.

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APPENDIX

Sex-age-specific birth-rate: Average number of live female births occurring in 1 year to a woman in age group $(x, x + 4)$.

Total fertility rate (TFR): The sum total of the age-specific birth rates over all fertile ages. The TFR is a gross measure of the average number of children to be born to a woman throughout her life cycle. This measure does not account for the woman's mortality throughout or prior to child bearing ages.

Gross reproduction rate (GRR): The sum total of sex-age-specific birth rates over all fertile ages. The GRR is a crude measure of the average number of females to be born to a female throughout her life cycle. Similar to TFR, GRR does not account for the female's mortality throughout or prior to child bearing ages.

Net maternity function: The expected number of female births that will occur to a newborn female during specified age internal, accounting for her mortality prior to reaching that age interval.

Net reproduction rate (NRR): The sum total of values obtained for the net maternity function for all age-groups. NRR is thus the expected number of females to which a newborn female will give birth during her lifecycle. It is, therefore, a replacement ratio for newborn females, under given regime of mortality and fertility. If the regime remains fixed, the NRR gives the population ratio between successive generations of females.

Length of generation: The time in which the population increases in the ratio of NRR.

Crude birth rate: Number of births per 1,000 population.

Intrinsic rate: The rate of population increase in the limit, considerations of migration excluded.